

**IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF PENNSYLVANIA**

UNITED STATES

Case No. 2:19-cr-00369-DWA

v.

LAFON ELLIS

REPORT AND RECOMMENDATION OF SPECIAL MASTER

I. INTRODUCTION

By Order dated October 21, 2021 (Docket No. 182), and pursuant to Federal Rule of Civil Procedure 53, the Court appointed this Special Master for the limited purposes of addressing the matters presented by Mr. Ellis' Emergency Motion (ECF No. 163) ("Motion"). The Motion asserts that Cybergenetics failed to produce materials this Court ordered to be produced in a July 23, 2021 Protective Order. (ECF NO. 161).

Mr. Ellis and the Government fully briefed the issues associated with the Motion. *See* ECF Nos. 163, 165, 166, 167. In connection with my assignment, I engaged in multiple conference calls and email communications with counsel for Mr. Ellis and the Government. Both Parties had an opportunity to direct me to filings in the record that they believed were germane to the issues presented by the Motion. In connection with the Motion, Mr. Ellis relied on three experts (Dr. Jeanna Matthews, Nathan Adams and Dr. Paul Martin) and the Government relied on two experts (Dr. Mark Perlin and Mark Krocchik). The experts submitted Declarations addressing the issues presented by the Motion. On December 20 and 23, 2021, I conducted a hearing that included the testimony of Drs. Matthews, Martin, Perlin and Mr. Krocchik. The Parties had an opportunity to examine the experts and I had an opportunity to ask questions. The Parties also presented closing arguments on December 29, 2021. All information and arguments presented by the Parties was reviewed and considered.

II. CYBERGENETICS' PRODUCTION

Cybergenetics made three environments available to the defense team on Windows laptop computers:

- (1) VUIer™ software;
- (2) TrueAllele executable software; and
- (3) TrueAllele source code, with a grepWin search program, a Notepad++ text editor review program, and its MATLAB software development environment containing relevant Toolboxes.

Cybergenetics asserts that it also supplied its TrueAllele Disclosure DVD materials for this case that included TrueAllele user manuals, tutorials, case data, and validation data. Dr. Perlin Decl. at 3.

Defense experts reviewed and inspected the produced materials. Dr. Adams engaged in an inspection on August 18, 19 and 20, 2021 and Dr. Martin engaged in an inspection on November 29 and 30, 2021.

III. DISPUTES RELATING TO CYBERGENETICS' PRODUCTION OF MATERIALS IDENTIFIED IN THE PROTECTIVE ORDER

In his Motion, Mr. Ellis asserts that during the inspection of the materials produced by Cybergenetics, his expert, Mr. Adams, identified missing materials in violation of Sections 3(b), 3(c), 3(d), 3(f) and 9(c) of the Protective Order. Relying on Dr. Martin's later inspection, Mr. Ellis alleged that Cybergenetics also violated Section 3(a) of the Protective Order. The Government opposes the Motion, arguing that Cybergenetics complied with the Protective Order. Each of the alleged violations of the Protective Order are addressed below, followed by my proposed resolution.

(1) Reasonable Testing

Section 9(c) of the Protective Order requires that “[a]ny source code produced in discovery shall be made available for inspection, in a format allowing it to be *reasonably* reviewed, searched and tested . . .” ECF 161 at 9(c) (emphasis added). A number of the

arguments relating to Cybergenetics' compliance with the Protective Order relate to what is, or is not, "reasonable testing" of probabilistic genotyping software, like the TrueAllele software used in this case. Because this issue permeates many of the other issues concerning Cybergenetics' compliance, the issue of reasonable testing will be addressed first.

Mr. Ellis' Position

Mr. Ellis argues that the source code provided was not reasonably reviewable or testable. Therefore, he asserts, a determination cannot be made as to whether the TrueAllele software used in this case is reliable when assessed according to the relevant disciplines, including computer science and software engineering. ECF 166 at 1.

Mr. Ellis disputes the Government's position that reasonable testing to determine reliability is empirical testing, such as running the software on a variety of DNA data samples on the executable version of the TrueAllele software. Mr. Ellis' experts opine that empirical testing is not sufficient to determine reliability.

To identify "reasonable testing", the defense experts assert that it is important to look to relevant sources, such as the Institute of Electrical and Electronics Engineers ("IEEE"). Dr. Martin relies on the IEEE publication titled "Software Engineering Body of Knowledge (SWEBOK) that details testing best practices. Martin Decl. at ¶ 28-30. He also relies on International Organization for Standardization ("ISO") Software Testing Standard 29119 and asserts that these best practices and guides describe a large set of possible testing methodologies and topics designed to help find programming errors in the implementation of software code. Martin Decl. at ¶ 29.

Drs. Martin and Matthews also rely on IEEE recommendations of testing for probabilistic genotyping systems that include independent verification and validation (IV&V or V&V) in accordance with IEEE Standard 1012. *Id.* at ¶ 32; Tr. 12/23/21 at 128. IEEE Standard 1012

describes several types of source code testing including acceptance, component and integration testing. Martin Decl. at ¶ 33. Mr. Ellis further argues that the source code produced does not provide the ability to do full unit testing and the defense experts cannot do testing necessary for IV&V. *See e.g.*, Tr. 12/20/21 at 79-80.

Finally, Dr. Martin also opines that a manual review of the source code to identify likely sources of errors would be difficult. TrueAllele has approximately 17,000 lines of source code written by multiple programmers over two decades and he estimates that it would take hours for a person to read through even a few dozen lines of code to decipher what it does. *Id.* at ¶ 37. Therefore, it would be unrealistic to expect that reading through the TrueAllele source code would yield meaningful information. *Id.*

Government's Position

The Government argues that the testing requested by Mr. Ellis is not reasonable because the defense experts are seeking unfettered access to the source code, which is unprecedented. In making these arguments, the Government points to the record leading up to the Protective Order. Specifically, The Government relies on the Court's April 23, 2021 Memorandum Order denying the Government's Motion To Quash in which Judge Ambrose made clear that only "some level of access to source code with proper restrictions represents reasonable outcome here". ECF 151 at 1. In that Order, Judge Ambrose did not grant the defense with unfettered access to Cybergeneitics' source code.

The Government relies heavily on the expert testimony of Dr. Perlin, the founder and Chief Scientist and Executive at Cybergeneitics. Dr. Perlin opines that "[s]cientific standards for testing probabilistic genotyping software are based on observing how executable software works on DNA input data produced under different biological conditions", not by testing the source code. Perlin Decl. at 8. Software testing starts by observing software program behavior and if

an issue arises, only then would a developer seek the cause, and examine and adjust the source code. *Id; see also* Krocchik, Tr. 12/20/21 at 159.

Dr. Perlin opines that there are many ways to conduct reasonable testing on TrueAllele to determine if it produces reliable results. Such testing includes: (1) running Ellis' DNA on the executable program provided; (2) running the Rutgers University more than 24,000 DNA mixture test data samples through TrueAllele to see if it provides the same results; (3) running Ellis' DNA through the five other probabilistic genotype software open source programs available to the defense team; and (4) looking at the core functions of the source code to see if they work as advertised. Perlin Decl. at 9. Additionally, the defense experts could reasonably test the source code using the MATLAB development environment provided on the computer.

Id. at 7.

Dr. Perlin testified that forensic DNA laboratories follow the national standards for validating probabilistic genotyping systems and do not have access to source code. Perlin Decl. at 9. Crime laboratory TrueAllele testing is empirical, conducted by running the software on a variety of DNA data samples. *Id.* Laboratories write up their testing findings as validation study reports. *Id.* For laboratory accreditation, external auditors review the laboratory's validation reports. *Id.* Forty-two validation study reports (including the published papers) have been prepared and were provided to the defense team. *Id.*

In refuting Mr. Ellis and his experts' position that empirical testing is not reasonable, the Government points to the IEEE letter dated November 18, 2021, relied upon Dr. Martin, in which IEEE makes recommendations to the National Institute of Standards and Technology (NIST). *See* Martin Decl., Ex. C. A "Key Takeaway" of the NIST document on "DNA Mixture Interpretation: A NIST Scientific Foundation Review" states that "[t]he degree of reliability of a component or a system can be assessed using empirical data. . . ." *See id.* at 5

(referencing Key Takeaway: #4.1). Dr. Matthews testified that as of this date, NIST has not adopted IEEE's recommendation that DNA mixture interpretation using DNA software should only be deemed reliable based on objective information gathered through IV&V as determined by IEEE Standard 1012. *See, e.g.*, Matthews, Tr. 12/23/21 at 172.

Analysis and Recommended Resolution

I have been charged by Judge Ambrose to address disputes raised by Mr. Ellis concerning Cybergenetics' compliance with the terms of the Protective Order. My role as Special Master is not to define the scope and limits of discovery, which is a matter for the Court.

The Protective Order does not address what is, or is not, "reasonable" as it relates to testing of the TrueAllele source code. Mr. Ellis acknowledges that "it could be argued that the relevant provisions at dispute between the parties in the Court's order are up for interpretation". ECF 166 at 2. He then argues that reasonableness, as it relates to whether the source code production is conducive to testing, should be interpreted by software engineering and computer science experts who are within the relevant scientific community of such review and testing. *Id.* Relying on software engineering and computer science experts, Mr. Ellis takes the position that his:

experts need complete and unfettered access to the program to inspect and test it. Less than complete and unfettered access to the program can only serve to inhibit review and testing activities.

Id. at 8.

His experts support the view that unfettered access to the source code for testing is reasonable and rely on, *inter alia*, the IEEE letter dated November 18, 2021 written to NIST which recommends that DNA software be independently verified and validated in accordance with IEEE Standard 1012. Martin Decl. Ex. C. While Dr. Matthews testified that such recommendations are the official position of IEEE, she acknowledged that NIST has not yet

adopted IEEE's recommendations. Matthews, Tr. 12/23/21 at 127, 172. More importantly, IEEE Standard 1012 is not mandatory. It is voluntary standard and IEEE recognizes that there may be other ways to test. An introductory page in IEEE Standard 1012 states that:

[u]se of an IEEE Standard is wholly voluntary. The existence of an IEEE Standard does not imply that there are no other ways to produce, test, measure, purchase, market, or provide other goods and services related to the scope of the IEEE Standard.

See Martin Decl, Ex. D, IEEE Standard 1012, 4th page (unpaginated).

The Protective Order does not say that IEEE compliance is required in connection with the reasonableness of testing. IEEE was only referenced in Section 3(c) of the Protective Order in relation to the production of:

software engineering and development materials describing the development, deployment, and maintenance of the version(s) of the TrueAllele software system used in the instant case, including the software engineering documents recommended by organizations such as the Institute of Electrical and Electronics Engineers or the Internal Organization for Standardization.

ECF 161 at 3(c).

Section 9(c) requires that source code produced in discovery be made available for inspection, “*in a format* allowing it to be reasonably reviewed, searched and tested . . .” ECF 161 at 9(c) (emphasis added). It does not require compliance with voluntary IEEE standards, let alone the robust requirements for IV&V recommended by IEEE Standard 1012.

While Mr. Ellis readily admits that his experts need complete and unfettered access to the program, it is notable that when cross examined by the Government, Defense expert, Dr. Martin, was unable to think of a specific example during his career where, in a litigation matter, he was provided with everything the defense is asking for in this case. Martin, Tr. 12/20/21 at 20 (ECF 193).

A review of the record leading up to Mr. Ellis' Motion reflects that Judge Ambrose did not intend for the defense to have unfettered access to Cybergenetics' source code. In a April 23, 2021 Memorandum Order denying the Government's Motion for Reconsideration, Judge Ambrose stated that "*some level* of access to source code with proper restrictions represents reasonable outcome here". ECF 151 (emphasis added).

I therefore reach the conclusion that the reference in Section 9(c) of the Protective Order, requiring the source code to be made available for inspection "in a format allowing it to be reasonably reviewed, searched and tested", does not include complete and unfettered access to the source code, as requested by Mr. Ellis.

(2) Complete Build Environment And Build Instructions

Mr. Ellis' Position

Mr. Ellis asserts that Cybergenetics is in violation of Sections 3(b), 3(c) and 9(c) of the Protective Order by failing to provide a complete build environment and build instructions. He takes the position that a complete build environment is a missing dependency required by Section 3(b) of the Protective Order and that the software cannot be reasonably reviewed and tested as required by Section 9(c) of the Protective Order without a complete build environment. Mr. Ellis further argues that build instructions are software engineering and development materials required by Section 3(c) of the Protective Order.

In support of that view, Dr. Martin opines that because the dependencies needed to build¹ and test the code, including a complete build environment and build instructions, are missing, the

¹ According to IEEE's Software Engineering Body of Knowledge (SWEBOK) version 3 relied upon by the defense experts:

Software building is the activity of combining the correct versions of software configuration items, using the appropriate configuration data, into an executable program for delivery to a customer or other recipient, such as the testing activity. . . . Build instructions ensure that the proper build steps are taken in the correct sequence.

Martin Decl., Ex. B at 6.1.

source code produced by Cybergenetics was not in a format that allowed it to be reasonably tested. Martin Decl. at ¶ 57. According to Dr. Martin, one of the best source code analysis tools is a fully functioning build environment, which allows the reviewer to compile the source code into a working program. *Id.* at ¶ 56.

Testing the executable version of the software, as suggested by the Government and Dr. Perlin, is insufficient, because according to Dr. Martin:

Providing an already built version of the source code along with the source code is not enough. To test source code, one would expect the ability to modify lines of code and rebuild the software and to interactively debug any object code built from the source code. In order to do these things, a proper build environment must be provided.

Id. at ¶ 69.

Defense experts, Dr. Matthews and Mr. Adams, further opine that to build a functionally identical version of the TrueAllele from the source code, build instructions are required. ECF No. 161 at ¶ 4. Build instructions should have been provided because Section 3(c) of the Protective Order requires production of “software engineering documents recommended by organizations such as the Institute of Electrical and Electronics Engineers [IEEE]” and build instructions are recommended by IEEE in its publication titled “Software Engineering Body of Knowledge (SWEBOK). ECF 166 at 6-7.

Without build instructions, the source code is not in a format allowing it to be reasonably reviewed, searched and tested in violation of section 9(c) of the protective order. Finally, Mr. Ellis argues that to the extent build instructions are not available, Cybergenetics should be required to generate such instructions.

Mr. Ellis also takes the position that build instructions did not need to be expressly named in the Protective Order because they fall into the category of materials to be provided under Sections 3(c) and 9(c) of the Protective Order. *Id.* at 8.

Government's Position

The Government argues that the Court never ordered Cybergenetics to provide materials sufficient for the defense experts to build or recreate the program. Such an order would give the defense experts complete and unfettered access to the program, which is not consistent with the verbiage of the Court order or the spirit or Order that provides Cybergenetics some protection for its trade secrets. ECF 165 at 3.

Cybergenetics produced the source code, which demonstrates how the program was constructed. The Government argues that the program took a team of sophisticated computer scientists years to build, and there are no step-by-step instructions for how to build a program with this degree of sophistication. *Id.* Even if step-by-step instructions were available, the defense expert is not qualified to re-create a program of this degree of sophistication, and, even if he was, it would take years to do correctly and who would pay for such an exercise. *See, e.g., id.* Rebuilding the program will not advance a determination of its reliability when the defense expert can test the executable program provided to the defense as opposed to a version of the program that Mr. Ellis' experts would attempt to rebuild, undoubtedly unsuccessfully. *Id.*

Dr. Perlin testified that Cybergenetics' source code includes build instructions in the context of the provided MATLAB programming environment. Perlin Decl. at 5. The MATLAB software is self-assembling. *Id.* Therefore, TrueAllele and other MATLAB software does not need or use the manual "build instructions" requested by the Defense. *Id.* Moreover, Dr. Perlin testified that TrueAllele cannot be built without connecting to other computers over a network, which is expressly prohibited by Section 9 of the Protective Order. *Id.*

Dr. Perlin further opined that the Defense can empirically test the executable version of TrueAllele on the DNA data in this case or on available validation data because Cybergenetics provided the Defense expert with an executable testing environment of “the version of TrueAllele used in this case from the source code.” *Id.* Such testing is consistent with the testing conducted by Cybergenetics’ software testers, forensic analysts, crime laboratory customers, university students and researchers, and other scientists test TrueAllele on the executable TrueAllele software they want to use. *Id.*

Finally, the Government argues that Mr. Ellis previously requested the complete build environment and build instructions but such requests were denied by Judge Ambrose and were not included in the final Protective Order that governs Cybergenetics’ production.

Analysis and Recommended Resolution

There is nothing in the express language of the Protective Order suggesting that Cybergenetics was required to provide Mr. Ellis and his experts with a complete build environment or that Cybergenetics was required to provide instructions for the defense to build a functionally identical version of the TrueAllele from the source code.

Although Mr. Ellis argues that it is not necessary for build instructions to be expressly named in the Protective Order, that position is not supported by the record in this case. Prior to issuance of the Protective Order, Mr. Ellis argued that Cybergenetics should be required to provide a build environment and build instructions. *See, e.g.*, ECF 83 at 26; ECF 143 at 2, 14. The Government opposed that production and Parties agreed to use a protective order used in *State v. Pickett*, No. A-4207-19T4, 2021 N.J. Super. LEXIS 17 (N.J. Super. Ct. App. Div. Feb. 3, 2021) with a change the Court made in response to a request by the Government. The final Protective Order in this case makes no reference to a build environment and build instructions that had previously been requested by Mr. Ellis.

The documents upon which Mr. Ellis' own experts rely also include express references to a build environment and build instructions that do not exist in the Protective Order for this case. For example, footnote 26 of the previously referenced IEEE letter to NIST provides a list of "information needed" to build, run and test the software and includes language similar to Sections 3(b), (c), (d), (e) and (f) of the Protective Order. *See* Martin Decl. at ¶ 32, Ex. C, n 26. As reflected in the comparison below, build instructions are expressly referenced as "information needed" in the IEEE letter but build instructions are not included in the similar language of the Protective Order in this case.

IEEE Letter Footnote 26 at Page 10	Section 3(c) of the Protective Order
Software engineering and development materials describing the development, deployment, and maintenance of the version(s) of the software system used in the instant case, including the software engineering documents <u>and build instructions;</u>	Software engineering and development materials describing the development, deployment, and maintenance of the version(s) of the TrueAllele software system used in the instant case, including the software engineering documents <u>recommended by organizations such as the Institute of Electrical and Electronics Engineers or the International Organization for Standardization;</u>

I find that Cybergenetics is not in violation of the Protective for failing to provide a complete build environment or build instructions.

(3) Databases

Mr. Ellis' Position

Mr. Ellis argues that Cybergenetics failure to provide databases, including the PostgreSQL database, on the source code computer constitute violations of Sections 3(b) and 9(c) of the Protective Order.

The defense experts take the position that these databases are software dependencies required by Section 3(b). Dr. Martin opines that a software developer would understand that a

software dependency is anything that is needed to run the software and he cites industry sources to support his view. Martin Decl. at ¶ 52-55. Without the databases installed and available on the source code inspection computer, Dr. Matthews and Mr. Adams take the position that it is reasonable to expect that TrueAllele's full functionality cannot be tested. *See, e.g.*, ECF 166 at 4.

Mr. Ellis also argues that his experts cannot engage in reasonable testing and review of the source code consistent with Section 9(c) of the Protective Order because they are unable to test and see how the source code works without the databases. Missing dependencies, such as databases, resulted in error states when attempting to run the TrueAllele source code, preventing system-level testing and many unit-level tests from being initiated and preventing execution path tracing from being conducted." *Id.* at 4-5.

In response to Cybergenetics assertion that it would be extremely difficult to produce source code connected to the database and might take a 2-5 year development effort to put on Windows laptop, Mr. Ellis argues that it was Cybergenetics' decision to put the source code on a Windows laptop and its decision in doing so should not preclude the production of the databases.

Government's Position

The Government argues that databases are not contemplated in the express language of the Protective order. The Protective Order only refers to libraries, toolboxes, plus-ins and frameworks as dependency examples. Dr. Perlin and Mr. Krocchik testified that each of those examples are code; databases are not code and are instead, data repositories. *See, e.g.*, Krocchik, Tr. 12/20/21 at 198; Perlin, Tr. 12/23/21 at 100.

Dr. Perlin testified that Cybergenetics provided all "software dependencies" by giving defense experts the TrueAllele source code in the MATLAB development environment. Perlin Decl. at 3. The MATLAB environment contains the requisite "external standalone libraries" of code for "software dependencies." *Id.*

As a regular business practice, Cybergenetics does not install databases on development computers or on any end user computers. *Id.* at 4. Access to the databases was made available through a network connection on the executable program, similar to how end users receive it. *Id.* Because database access from a Cybergenetics' source code review computer can only be made through a network connection to an external database computer, the Government argues, it was not contemplated by the Protective Order. Instead, Section 9(c) of the Protective Order prohibits such connections and therefore does not allow connecting the source code review computer to an external database.

Dr. Perlin also opined that any access to the TrueAllele database would present security concerns because the database contains sensitive information that can compromise the security of installed systems, as well as violate insurance policies and contracts with customers. Perlin, Tr. 12/23/21 at 53, 94.

Access to databases from the source code computer is unnecessary for source code review or testing lines of source code. Cybergenetics provided defense experts with a TrueAllele testing environment that was connected to a database that can be used for normative empirical testing of executable software on DNA data. Perlin Decl. at 4. As such, Dr. Perlin asserts that TrueAllele's full functionality can be examined. *Id.*

Finally, if required to provide the databases on the source code computer, Dr. Perlin testified that it would be difficult to produce and could be a 2-5 year development effort to put on Windows laptop. Perlin, Tr. 12/23/21 at 86. The Government argues that such work is not consistent with discovery and would require an unreasonable amount of time and resources.

Analysis and Recommended Resolution

The express language of the Protective Order does not make any reference to databases. Prior to issuance of the Protective Order, Mr. Ellis argued that Cybergenetics should be required

to provide databases. *See, e.g.*, ECF 83 at 26; ECF 143 at 2, 14. The Government opposed that production and Parties agreed to use a protective order used in *State v. Pickett*, No. A-4207-19T4, 2021 N.J. Super. LEXIS 17 (N.J. Super. Ct. App. Div. Feb. 3, 2021) with a change the Court made in response to a request by the Government. The final Protective Order in this case makes no reference to databases that had previously been requested by Mr. Ellis.

It is also notable that footnote 26 to the previously referenced IEEE letter relied on by Mr. Ellis' experts includes language similar to that included in Section 3(b) of the Protective Order but makes express reference to "databases". A comparison of the language relating to databases in footnote 26 of the IEEE letter and the language of Section 3(b) of the Protective Order is listed below. The Protective Order in this case does not include a reference to "databases".

IEEE Letter Footnote 26 at Page 10	Section 3(b) of the Protective Order
All software dependencies including third-party code libraries, toolboxes, plug-ins, frameworks <u>and databases</u> ;	All software dependencies including third-party code libraries, toolboxes, plug-ins, and frameworks;

Further support for the view that databases were not intended to be provided with the source code is the express language of the Protective Order that prohibits source code inspection with Internet access or network access to other computers. Because database access from a Cybergenetics source code computer can only be made through a network connection to an external database computer, such access was not contemplated by the terms of the Protective Order. Cybergenetics did however provide the defense with an executable version of the TrueAllele testing environment that was connected to a database.

I find that Cybergenetics is not in violation of the Protective Order for failing to provide databases on the source code computer.

(4) Missing Source Code

Mr. Ellis' Position

Section 3(a) of the Protective Order requires production of “TrueAllele source code for the version used in the instant case”. Mr. Ellis’ experts assert that all of the source code was not produced and some files were not produced as they were stored in normal course of business. Martin Decl. at ¶¶ 61-65.

Specifically, Dr. Martin opined that during his inspection of the source code, he observed references to files and code that did not appear to have been produced and suggests that it is possible additional files and code are missing. Martin Decl. at ¶ 66. Mr. Ellis and his experts assert that omission of these files prevents the defense from reasonable review and testing of the source code in violation of Sections 3(a) and 9(c) of the Protective Order. *Id.*

Dr. Martin further testified that the source code production of 4,432 files lacked any directory structure that would be expected. *Id.* at ¶ 63. The flatness of the folder structure appeared to be an artificial construct of the production. *Id.* at ¶ 64. Without the source code in the proper directory structure, Dr. Martin opined that the code cannot be reasonably tested as any links between the files in the source code are broken and therefore the code with such links will not run. *Id.* The modified directory structure also has the effect of obfuscating the true relationship of the files to each other. *Id.* at ¶ 66.

Government's Position

Dr. Perlin acknowledged that some portions of the source code were not made available but asserts that such source code was reasonably excluded and irrelevant. Perlin, Tr. 12/23/21 at 52. The only source code that was not made available was source code relating to security keys, encryption keys, passcodes, passwords and accessing other machines. *Id.* at 49, 90. The security mechanisms were removed because they provide access to Cybergeneitics and its customer’

computers and such codes are not part of how the system functions and therefore, are irrelevant. *Id.* at 49-50. Dr. Perlin also testified that production of such codes would violate Cybergenetics' contracts with customers and its insurance policies. *Id.* at 53. The Government and Dr. Perlin argued that such restrictions were reasonable and it would be irresponsible to give passcodes and opportunities to break into Cybergenetics' system. *Id.* Further, because the Protective Order prohibits connecting the source code review computer to the Internet, networks, or other computers, access to the source code connections was removed.

With regard to the defense experts' testimony that the source code lacked any directory structure, Dr. Perlin testified that he wrote a program to put the files on a Windows PC. *Id.* at 90.

Analysis and Recommended Resolution

Section 3(a) of the Protective Order required Cybergenetics to produce "TrueAllele source code for the version used in the instant case". While the Protective Order did not exclude certain files from production, given recent high profile cybersecurity incidents, Cybergenetics' concerns involving the security of its computers and that of its customers must be taken seriously. It is not clear how much source code Cybergenetics removed for security reasons but no evidence was presented to suggest that anything more than security keys, encryption keys, passcodes, passwords should be removed from the source code. To the extent that Cybergenetics removed additional source code, such source code should be produced and all security keys, encryption keys, passcodes, passwords may be redacted.

With regard to Cybergenetics failure to produce source code relating to connections for the databases, the Protective Order does not exclude such source code from production and it should be produced on the source code computer. Because the source code computer is not connected to the internet, networks or other computers, there is no reason to believe that there are

concerns about accessing the databases. Cybergenetics may however redact security keys, encryption keys, passcodes, passwords or other log in credentials associated with access to the databases if such codes are embedded in the source code.

Cybergenetics should also produce the source code files with directory structures that exist in the source code as they are kept at Cybergenetics in the normal course of business. To the extent that directory structures were removed, by virtue of the fact that a program was written to put the files on the Windows PC or otherwise, Cybergenetics should be required to produce source code files in the structure as they are maintained at Cybergenetics.

(5) Other Software Engineering And Development Materials

Mr. Ellis' Position

Section 3(c) of the Protective Order requires the production of “Software engineering and development materials describing the development, deployment, and maintenance of the version(s) of the TrueAllele software system used in the instant case, including the software engineering documents recommended by organizations such as the IEEE or ISO.

Mr. Ellis argues that documents recommended by IEEE and ISO were not produced by Cybergenetics and therefore, Cybergenetics is in violation of the Protective Order.

Government's Position

Dr. Perlin testified that the IEEE standards apply to large-scale multi-party software development projects that require planning and coordination across many people, locations, or organizations and such project approaches are irrelevant. Perlin Decl. at 5. For smaller organizations, like Cybergenetics, the forensic industry's national standards for ensuring the reliability of probabilistic genotyping are most relevant. *Id.* These scientific software standards are based on empirical testing of relevant DNA data. Cybergenetics produced five TrueAllele standard compliance documents that Cybergenetics provided on the Disclosure DVD. *Id.* Dr.

Perlin also testified that Cybergenetics provided the software engineering documents it had available, including a 51- page “VUIer Updates” document describing software updates, changes, improvements, new features, bugs, and fixes in prerelease testing versions. *Id.* at 4.

Analysis and Recommended Resolution

Cybergenetics does not rely on IEEE standards and it cannot produce software engineering and development materials that it does not have in its possession, custody or control. Dr. Perlin testified that Cybergenetics produced TrueAllele standard compliance documents and therefore, there is no violation of Section 3(c) of the Protective Order.

(6) Records Of Software Glitches, Crashes, Bugs, Or Errors

Mr. Ellis’ Position

Section 3(d) of the Protective Order requires production of “[a]ll records of software glitches, crashes, bugs, or errors encountered during the TrueAllele developmental validation study”. In his Motion, Mr. Ellis argued that Cybergenetics failed to disclose any records.

Government’s Position

Dr. Perlin asserts that the developmental validation studies were conducted on thoroughly developer-tested TrueAllele software. Perlin Decl. at 6. Therefore, no “software glitches, crashes, bugs, or errors” were encountered during these studies. *Id.* Hence, no such records exist. *Id.*

Analysis and Recommended Resolution

Because no records of software glitches, crashes, bugs, or errors encountered during the TrueAllele developmental validation study exist, there are no records to produce. There is no violation of Section 3(d) of the Protective Order.

(7) Software Version

Section 3(e) of the Protective Order is not in dispute.

IV. CONCLUSION

It is my recommendation that Cybergenetics' Motion be granted in part and denied in part. Cybergenetics should produce:

- a) all source code files, including source code with connections to databases with the exception that security keys, encryption keys, passcodes, passwords or other log in credentials may be redacted; and
- b) source code files with directory structures that exist as the source code is kept at Cybergenetics in the normal course of business.

All other demands by Mr. Ellis that Cybergenetics produce further materials under the terms of the Protective Order should be denied.

Respectfully Submitted

/s/ Sandra A. Jeskie
Sandra A. Jeskie
Special Master

Dated: January 17, 2022